College of San Mateo
Official Course Outline

1. **COURSE ID:** PHYS 210 **TITLE:** General Physics I **C-ID:** PHYS 105, PHYS 100S (PHYS 210 & PHYS 220)
   Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 48.0-54.0 Lab hours; 96.0-108.0 Homework hours; 192.0-216.0 Total Student Learning hours
   Method of Grading: Letter Grade Only
   Prerequisite: MATH 130

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
   CSU GE:
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B1 - Physical Science
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
   IGETC:
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: A: Physical Science
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   First course in a two semester non-calculus-based physics sequence. Topics covered include: Kinematics, Newton's Laws of Motion, Work and Energy, Momentum, Rotational Motion, Mechanical Equilibrium with Skeletal/Muscular Applications, Fluids, Thermodynamics, Oscillations, Waves and Sound.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Identify problems that should be solved using Newton's Laws of Motion and correctly solve them.
   2. Identify problems that should be solved using the Work-Energy Theorem and correctly solve them.
   3. Identify problems that should be solved using Conservation of Momentum (Linear and Angular) and correctly solve them.
   4. Identify and correctly solve problems involving ideal gases. This may include defining an ideal gas, using the ideal gas law (equation of state), problems involving work and energy, distribution of speeds, definition of temperature, explanation of Cv for a diatomic gas, and identifying whether a cycle is a heat engine or not and computing its efficiency.
   5. Identify problems that should be solved using the First and/or Second Law of Thermodynamics and correctly solve them.
   6. Collect and analyze data to verify physics principles.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Identify problems that should be solved using Newton's Laws of Motion and correctly solve them.
   2. Identify problems that should be solved using the Work-Energy Theorem and correctly solve them.
   3. Identify problems that should be solved using Conservation of Momentum (Linear and Angular) and correctly solve them.
   4. Identify and correctly solve problems involving ideal gases. This may include defining an ideal gas, using the ideal gas law (equation of state), problems involving work and energy, distribution of speeds, definition of temperature, explanation of Cv for a diatomic gas, and identifying whether a cycle is a heat engine or not and computing its efficiency.
   5. Identify problems that should be solved using the First and/or Second Law of Thermodynamics and correctly solve them.
   6. Collect and analyze data to verify physics principles.

   General objectives:
   1. Recognize some of the fundamental laws of nature and express them in mathematical form.
   2. Apply the laws of nature to the solution of problems. State the range of validity of each law, express the

relevant law(s) in mathematical form appropriate to the specific problem, and solve the resultant equation(s) for the unknown quantity or quantities.
3. Use the language and notation of physics correctly. Communicate explanations of physical phenomena in writing.
4. Demonstrate good problem-solving habits, including: 1) organizing given information and determining which physical principles apply to the problem. 2) considering a variety of approaches to a given problem, and selecting one that is appropriate. 3) estimating solutions and recognizing unreasonable results. 4) interpreting solutions correctly, and answering the questions that were actually asked.
5. Develop skill in laboratory procedures, including: 1) explain the purpose of each experiment, 2) correctly use laboratory equipment, 3) record data with proper attention to units and significant figures. 4) Analyze data and draw conclusions. 5) Write clear and concise lab reports.

6. **COURSE CONTENT:**

Lecture Content:

1. Kinematics (4-7 lecture hours)
   A. Definitions of Kinematic Variables
   B. Motion in One and Two Dimensions with Constant Acceleration
   C. Free Fall Projectile Motion

2. Newton's Laws of Motion (5-8 lecture hours)
   A. Statement of the Laws and types of Forces
   B. Applications with Linear and Circular Motion including Planetary Motion

3. Work and Energy (3-6 lecture hours)
   A. Work, Power, Kinetic Energy and the Work-Energy Theorem
   B. Potential Energy, Conservative and Non-Conservative Forces and Conservation of Energy

4. Momentum (4-5 lecture hours)
   A. Impulse and Momentum
   B. Conservation of Momentum
   C. Center of Mass

5. Rotational Motion (6-11 lecture hours)
   A. Rotational Kinematics and Linear and Angular Quantity Relations
   B. Moment of Inertia and Energy of Rotating and Rolling Objects
   C. Torque and Angular Acceleartion
   D. Angular Momentum and its Conservation
   E. Mechanical Equilibrium with Skeletal/Muscular Applications

6. Simple Harmonic Motion (3-4 lecture hours)
   A. Simple Harmonic Motion of a Mass on a Spring
   B. Simple and Physical Pendula
   C. Damping and Resonance

7. Fluids (2-4 lecture hours)
   A. Fluid Statics: Pressure in a Static Fluid and the Buoyancy Force
   B. Fluid Dynamics: Continuity Equation and Bernouli's Equation

8. Thermodynamics (8-13 lecture hours)
   A. Temperature and Thermal Expansion
   B. Calorimetry
   C. Ideal Gases and Kinetic Theory of Gases
   D. First law of Thermodynamics and Applications
   E. Heat Engines, Refrigerators and Heat Pumps
   F. Second Law of Thermodynamics and the Carnot Cycle
   G. Entropy

9. Waves (3-6 lecture hours)
   A. Types of Waves and Properties of Waves
   B. Standing Waves on a String and in Air Columns

C. Sound Waves: Beats, Decibles and the Doppler Effect

Lab Content:

Labs: In a typical semester students complete 14-17 labs from the following:

- Lab 1 - Basic Measurements, Basic Calculations, and Conversion of Units
- Lab 2 - The Acceleration Due to Gravity
- Lab 3 - Equilibrium of Concurrent Forces
- Lab 4 - Newton's Second Law
- Lab 4A - Newton's Second Law with Computers
- Lab 5 - Centripetal Force
- Lab 6 - Conservation of Momentum
- Lab 7 - The Ballistic Pendulum
- Lab 8 - Moment of Inertia
- Lab 9 - Center of Gravity
- Lab 10 - Equilibrium of a Rigid Body
- Lab 11 - Archimedes' Principle
- Lab 12 - Linear Simple Harmonic Motion
- Lab 13 - Standing Waves on a String
- Lab 14 - Specific Heat Capacity
- Lab 15 - Heats of Fusion and Vaporization
- Lab 16 - Thermal Conductivity
- Lab 17 - Gas Laws - A Qualitative Study

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

A. Lecture
B. Lab
C. Activity
D. Discussion
E. Experiments
F. Observation and Demonstration
G. Other (Specify): 1. Lecture: Introduce and explain the concepts, define the appropriate terms, provide examples and solve problems to illustrate the application of the concepts. 2. Demonstrations: Use physical demonstrations to reinforce the understanding of the physical concepts. 3. Collaborative learning: Guided discussions and in class exercises, which lead to clarification of the concepts and sharpen the problem solving skills. 4. Homework assignments: Outside of classroom problem solving which helps further student understanding of concepts, including the range of validity, and develops the ability to apply the concepts. 5. Laboratory work: Group and individual work to investigate physical principles; observe, record, and analyze the results of experiments, which deepens the understanding of concepts introduced during in lecture.

8. **REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

Students complete written laboratory reports in which they analyze the results of experiments performed in the lab. This analysis requires critical thinking and requires students to connect lecture topics to the experiments performed. These assignments also require students to effectively communicate their ideas in writing.

Reading Assignments:

Reading the textbook prior to lectures to become familiar with the topics to be presented. Reading the textbook after lectures to review the key points and concepts.

Other Outside Assignments:

Solving textbook (or similar) problems after each lecture. Problems are of varying difficulty and are completed by students to help further their understanding of the concepts and to learn how physics formulas and mathematics are used to apply the concepts to specific situations.

9. **REPRESENTATIVE METHODS OF EVALUATION**

Representative methods of evaluation may include:

A. Class Participation
B. Exams/Tests
C. Homework

D. Lab Activities
E. Quizzes
F. 1. Lab activities require students to participate in performing measurements and observations during the lab period. Lab reports assess students' careful recording of observations and measurements, correctness of calculations, and critical thinking ability. Furthermore, these reports evaluate students' ability to communicate their results in clear writing. Department policy is that students must pass the lab portion of the course to receive a grade of "C" higher. 2. Homework assignments allow students to receive feedback from instructors on their understanding of the material before they are required to demonstrate their understanding on the exams. Homework problems require and develop critical thinking and other problem solving skills. 3. Exams are designed to assess both students' conceptual understanding of the material and their problem solving skills, logical reasoning, and analytic thinking. Department policy is for a comprehensive final exam to be required which accounts for at least 20% of a student's grade.

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. Young, H., D., Adams, P. W., Chastain, R. J.. *College Physics*, 11 ed. Pearson, 2020
Other:
A. Physics 210 Lab Manual, CSM Physics Department (revised yearly) available online at http://www.collegeofsanmateo.edu/physics

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Effective Term: Fall 2021
Course Originator: Alex Wong